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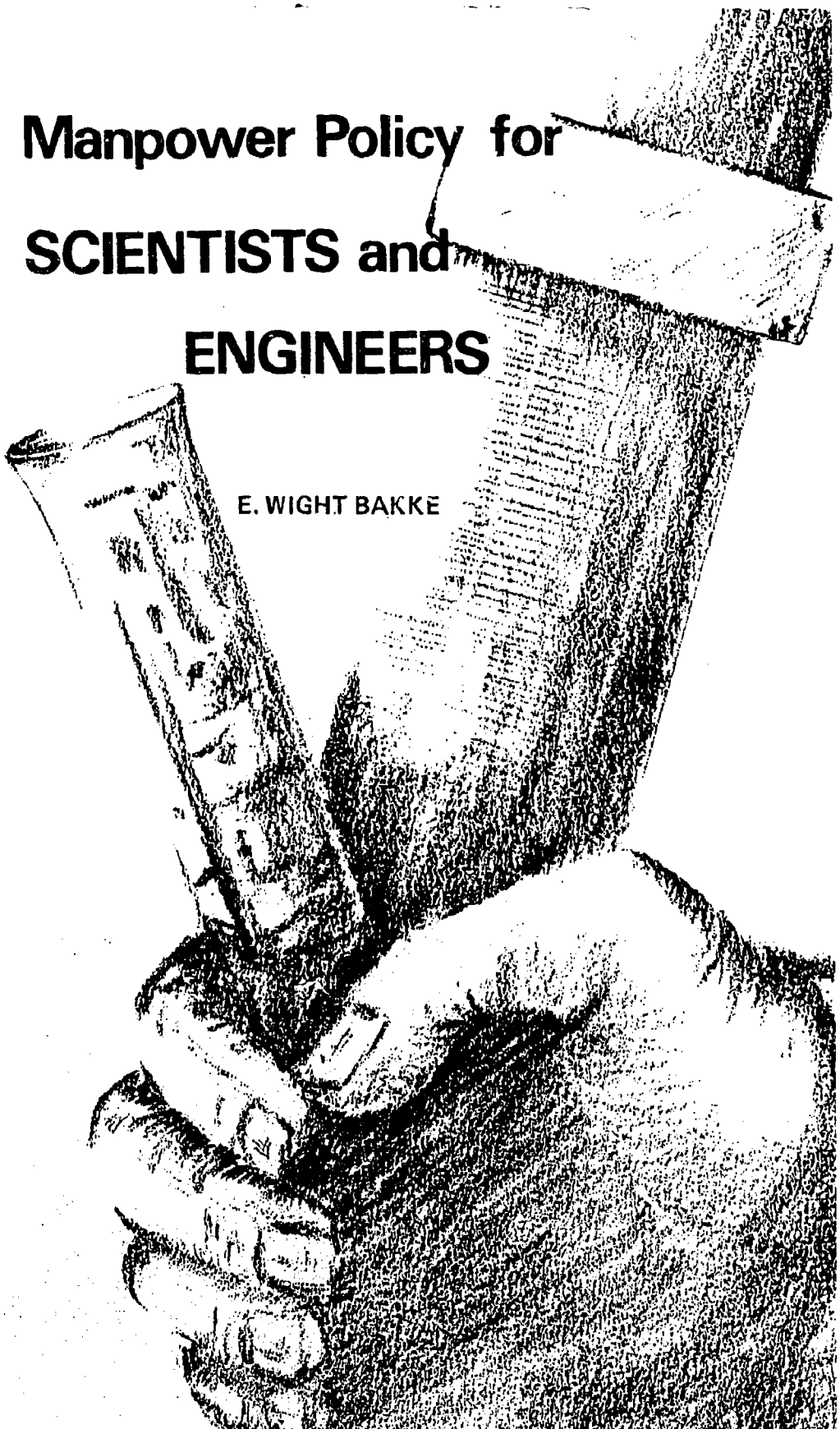
ABSTRACT

Until recently national manpower policies and programs have focused relatively little attention on the more skilled and better educated segments of the labor force. The concept of "manpower" has emphasized the training and placement of the disadvantaged. But a comprehensive manpower program must focus on the employment problems of individuals at all levels of occupational structure. Two critical aspects of the manpower problems of scientific and engineering personnel are their present substantial unemployment and the long-range equation of supply of and demand for educated manpower, both quantitatively and qualitatively. The welfare of the nation rests more heavily on the relatively small numbers of professional personnel, particularly scientists and engineers, than on any other occupational group. The effective development and utilization of talent and competence represent a challenge to the nation equal in importance to providing training and employment opportunities for the disadvantaged, and the federal government bears responsibility for both. The document presents policy directions to make the development, conservation, and utilization of scientific and engineering talent an integral part of a comprehensive national manpower policy. (MF)

# Manpower Policy for SCIENTISTS and ENGINEERS

E. WIGHT BAKKE



## THE NATIONAL MANPOWER POLICY TASK FORCE

# MANPOWER POLICY FOR SCIENTISTS AND ENGINEERS

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## FOREWORD

The last time I saw E. Wight Bakke was at a meeting of the National Manpower Policy Task Force on November 18, 1971, in Washington, at which a draft of the present paper was discussed. A few days later he died in his sleep, bringing to a sudden end a most distinguished career in labor economics. At the time of his death he was Sterling Professor of Economics at Yale University which had been his academic home for more than a third of a century.

Bakke was always a pioneer, from his pathbreaking studies of the unemployed during the depression of the 1930's to this last effort, in which he extends the reach of manpower policy to include a concern with educated, particularly scientific and engineering, manpower. He never doubted that a truly comprehensive labor market policy must include provisions for all the members of the labor force, in fact, for the entire population of working age, since every human being has the potential for making a contribution through work to his society, and every responsible society has the obligation to provide optimal opportunities for all its citizens to work productively.

Bakke was the principal author of the successive drafts of the present paper, although he had the advice and counsel of three colleagues, Frederick Harbison, Charles Myers, and M. H. Trytten. Final work had not been completed at the time of his death, and the Task Force had not reached a final decision about the specifics of the statement or its policy recommendations. But Bakke's unexpected passing and Trytten's resignation created a new situation for the Task Force, and subsequently my colleagues entrusted me with the task of preparing for publication Bakke's last draft with his penciled annotations, which had been made available by Mrs. Bakke. I gladly assumed this task as a token of friendship for an esteemed co-worker for whose work and values I have long had the deepest admiration.

In preparing the paper for publication I have been guided by two principles: to let Bakke's ideas and formulations which were developed and polished remain untouched; and to make usually small, but occasionally large, changes mostly in the form of deletions where I knew this able craftsman anticipated further change and improvement. I have indicated in the notes and com-

ments my more radical editorial decisions and the reasons for them. I have tried conscientiously to keep my own views, and those of the other Task Force members, from intruding where they are in disagreement with Bakke's thoughts.

One question remains: to what extent do the members of the Task Force agree with the thrust of Bakke's analysis? They believe, with Bakke, that the development, conservation and effective utilization of scientific and engineering manpower should be an essential element in any comprehensive national manpower policy. The Task Force members, however, differ on the choice of policy options which are raised for discussion at the end of the paper. These deserve further study and consideration, but, with Bakke unable to contribute his wisdom and his warmth to such discussion, the Task Force decided to note that differences remain. We are proud to make public this last contribution of our friend and colleague, E. Wight Bakke, whose good works continue even after his death.

Eli Ginzberg

February 1972

# INTRODUCTION

The National Manpower Policy Task Force in its January 1969 policy statement, "The Nation's Manpower Programs" included a section on scientific and professional manpower.[1] We believe that there is a need at the present time to review the policies affecting this group with an aim of determining how its contribution can be maximized in seeking the full employment of our nation's human resources in the pursuit of the individual and collective goals of the American people.

Until recently, national manpower policies and programs have focused relatively little attention on the more skilled and better educated segments of the labor force. The effort to synchronize the numbers and qualifications of persons with baccalaureate and higher degrees with the need and demand for their services has had relatively low priority. Although the federal, state, and local governments through their financial support for colleges and universities and for low income students impact directly on the future supply of educated persons, the concept of "manpower," as operationally defined by the programs of the U.S. Department of Labor, has emphasized the training and placement of the disadvantaged members of the labor force. It does not detract from the importance of this latter objective to assert that a comprehensive manpower program must focus on the employment problems of individuals at *all* levels of occupational structure.

## The Short and the Long of It

There are two critical aspects of the manpower problems of scientific and engineering personnel—one immediate and short range; the other, continuing and long range.

The first is present substantial unemployment and the inexcusable wastage of human resources which this represents. The federal government must bear a large degree of responsibility for this situation. And certainly, the avoidance of such wastage now and in the future is a proper function for federal policy.

The second critical aspect is the long-run match-up of the supply of and demand for educated manpower, in both quantitative and qualitative terms. If our national goals are to be met, this match-up should not be left to chance, or to market forces poorly adapted to achieving a timely balance for manpower whose preparation involves a long lead time. The federal government has a role to play to supplement private manpower planning to assure that the trained personnel needed to achieve long range national goals are available.

## Justification

The justification for focusing attention on scientific and engineering manpower lies in the critical role of this group in the production of goods and services essential to national strength and human welfare. The welfare of the nation, its quality of life, and its protection from within and without rests more heavily on the relatively small numbers of professional personnel, particularly scientists and engineers, than any other occupational group. The nation cannot remain indifferent to the forces governing their development and utilization without placing its own future in jeopardy.

The nurturing and conservation of scientific and engineering talent are objectives equal in importance to the national interest (and clearly instrumental to) assisting disadvantaged workers. For example:

1. Scientists and engineers play key roles in the processes of production in a sophisticated technological economy. They are largely responsible through their role in research and development for innovations and new directions for industrial progress and advances in productivity.
2. Insofar as a favorable balance of payments is an important ingredient in the nation's economic health and in its capacity to provide expanding employment opportunities, it should be noted that our chief foreign trade advantage is in the export of science-based goods and services.
3. Improvements in the quality of American life in the future is heavily dependent on the problem-solving efforts of scientists and engineers in such critical fields

as urban renewal and reconstruction, ecological restoration, population-resources equilibrium, and natural resource maintenance.

4. Finally, there are important international goals to the achievement of which scientists and engineers are directly and critically related, such as the maintenance of American intellectual leadership, assuring that the United States maintains requisite political, economic, and military strength among the world powers, and enabling this country to provide technical assistance to the developing nations.

## SECTION I

### The Immediate Problem

The evidence concerning current (late 1971) employment of educated manpower, particularly scientists and engineers, is not reassuring. Unemployment has increased dramatically in certain occupational groups, industries, and geographic regions, reflecting in considerable measure reductions in expenditures for defense and space, compounded by a slack civilian economy.

### The Case for Action

The recent dramatic change in the labor market for professional personnel, notably scientists and engineers, has been frequently described, sometimes in lurid language. The hard facts are disquieting. Since January 1969 the employment outlook for highly trained manpower has changed dramatically, and in some respects catastrophically. On the basis of the figures released by various federal agencies in mid-1971 it is possible to make a rough estimate of the number of unemployed scientists and engineers. One datum reports 150,000 unemployed scientists, engineers, and technicians. If technicians account for about half of the total, then the number of unemployed scientists and engineers approximates 75,000. The Bureau of Labor Statistics calculates the total college educated scientific and engineering work force as 1.5 million which would mean that they have an unemployment rate in the range of five percent.[2]

To provide a more up-to-date picture of unemployment among scientists, especially those at the doctorate level, the National Science Foundation sent a questionnaire in the spring of 1971 to 300,000 persons included in the 1970 Register of Scientific and Technical Personnel. A similar questionnaire was distributed to engineers.[3] The major findings showed a substantial rise in unemployment for both scientists and engineers over the year from 1.5 percent to 2.6 percent for scientists and from 1.6 percent to 3 percent for engineers. Over half the unemployed scientists were in Physics or Chemistry, the unemployment rates averaging 3 percent for Chemistry and 3.9 percent for Physics, approximately double for the rates for 1970. Research and development represented the previous work activity of three-fifths of the unemployed scientists compared to two-fifths of all registrants. About 45 percent of the

unemployed reported their last science-related employment was supported at least in part from federal funds. The report shows unemployment among scientists increasing steadily. Of the 6,300 unemployed scientists, more than half had lost their jobs since January 1, 1971. The average length of time that they had been out of work was seven months.

## Federal Responsibility

The moral issue presented by the widespread unemployment of scientists and engineers is one which the federal government cannot ignore. The National Science Foundation estimates that the jobs of about 2 out of 5 scientists and engineers depend on federal appropriations. Other studies point to the fact that 3 out of 5 aeronautical engineers depend on federal programs for their employment. Of the approximately 2 million scientists, engineers and technicians employed at the beginning of 1970, approximately 1 in 4 was engaged in work generated by the Department of Defense, the National Aeronautics and Space Agency, or the Atomic Energy Commission.[4] With the federal government's programs absorbing a substantial percentage of the total employable labor force in specific occupational groups any sudden decline in support for such programs will result in the discharge of such large numbers of persons with specialized capabilities as to preclude their reabsorption. The elasticity of the labor market for professional personnel can adjust to marginal variations in supply or demand but it cannot meet the challenge of large-scale discharges resulting directly from a change in federal policy.

Changes in federal policy are clearly responsible for most of the present difficulties. The abrupt shift in the federal government's priorities, resulting in the winding down of the Indo-China conflict, the reduction in defense expenditures, the sharp cuts in NASA's budget, and the abandonment of development work on supersonic aircraft, has been reflected in a marked weakening of demand for scientists and engineers as was highlighted in the 1971 *Report of the Council of Economic Advisors.*[5]

The industrial and geographical concentration of employment of scientific and engineering manpower in federally supported projects resulted in a corresponding concentration of

unemployment when federal support was cut back. Between 1967 and 1971 the Boeing Company let go approximately half of all its employees with college degrees.[6]

Technical personnel in the twin fields of defense and aerospace have been especially vulnerable to the decline in employment opportunities. Their expertise is often so highly specialized as to make lateral transfers to other industries difficult or impossible. Moreover they are often far distant from the centers of civilian work which means that even if jobs are available they require painful adjustments in living arrangements.

Coincident with the drop in employment for professional personnel in defense and aerospace industries, there has been less federal support for academic scientific activities. The total decline in real dollars has been on the order of 4 percent, but adjustments within the total resulted in much larger declines for certain types of scientific and engineering work.

Federal programs that employ large numbers of educated persons are inherently vulnerable to sudden shifts in the political arena and as such manifest more instability than programs that depend on the profit-seeking proclivities of private entrepreneurs. But that makes more urgent the need for preventative and rehabilitative action by the federal government. Because the government is largely responsible for the current plight of scientists and engineers, equity calls for remedial public action.

To this end, the White House announced in April 1971 an allocation of $42 million to assist unemployed scientists, engineers, and technicians who were victimized by the defense-aerospace cutbacks to help them find new jobs. The federal government is to be commended for recognizing its obligation to assist these unemployed persons to whose distress it so directly contributed. But this effort is inadequate.[7] Much more can be done in the short run to alleviate the problems posed by the abrupt reduction of federal programs and its untoward impact on professional personnel and reduce the wastage of valuable human resources by salvaging to the maximum degree possible their skills and talents for constructive use.

## NOTES AND COMMENTS

1. The author used the working title "High Talent Manpower Policy" and defined scientists to include both "natural and social scientists." A careful reading of his *Third Draft* indicates that his primary focus is on scientific and engineering manpower, the term adopted for publication.

2. A Bureau of Labor Statistics report lists the following distribution of college graduates:

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| Chemists | 130,000 |
| Engineers | 1,100,000 |
| Geologists and geophysicists | 30,000 |
| Mathematicians | 70,000 |
| Physicists | 45,000 |
| Life Scientists | 168,000 |
| | 1,543,000 |

3. *Unemployed Rate for Scientists*, Spring, 1971, NSF 71-26. About 85 percent responded, representing about half of the total pool of scientists. The resulting unemployment estimates are definitely on the low side. Also, *Unemployment Rate for Engineers in June and July of 1971*, NSF 71-33.

4. Mottur, Ellis, *Conversion of Scientific and Technical Resources*, Program of Policy Studies, George Washington University, Monograph No. 8, March 1971.

5. This *Report* indicated that by the third quarter of 1970, defense purchases had declined by 18 percent from their peak in the second quarter of 1968, and that during fiscal year 1971 the total numbers employed by defense purchases decreased by 1.8 million workers.

6. Stanley Little, Director of Industrial Relations for the Boeing Company, reported in June 1971 that from 1967 (approximately the date of maximum employment) total employment dropped from 168,000 to 54,000 and by the end of 1971 it will have dropped another 10,000. Among those with college degrees, the corresponding decline was from 22,000 to 11,000 with another 2,000 scheduled to be released by the end of 1971.

7. The program provides funds for retraining, job search, mobility allowances, and a wide range of additional services including the development of an unemployment register, special counseling, and research on skill conversion.

8. What the future may hold in respect to the need for human resources in specialties requiring advanced education and training can be glimpsed from a study, by the National Science Board in June, 1971 entitled *Environmental Science—Challenge of the Seventies*. While noting that there has been a sharp rise in the vigor and development of environmental science, the report observes: "Environmental science, today, is unable to match the needs of society for definitive information, predictive capability, and the analysis of environmental systems as systems. Because existing data and current theoretical models are inadequate, environmental science remains unable in virtually all areas of application to offer more than qualitative interpretations or suggestions of environmental changes that may occur in response to specific actions." The report points to two reasons for this state of affairs: "(1) The natural environment is not a collection of isolated events and phenomena but rather a vast, integral, mutually interacting system. (2) The trained scientific manpower available to meet the challenge is extremely

limited in each of the essential aspects of environmental science." The report sums up by stating, "The situation constitutes a crisis for the nation. While environmental problems are so diverse and diffused that virtually every activity of civilization interacts with the environment, few persons can be aware of the full scope of challenge that lies ahead. The current mismatch between capability and need is at least comparable to any other challenge to science and technology that we encountered during this century!"

9. According to Dr. John S. Foster of the Department of Defense, the higher education establishments of the U.S.S.R. are graduating consistently and increasingly more scientists and engineers that the U.S. by a factor of roughly two to one.

10. *Toward a Science Policy for the U.S.*, House Committee on Science and Astronautics, GPO 1970.

11. *Science*, April 9, 1971.

12. Cartter calculates a demand for doctorates other than for teaching of about 130,000. He calculates the demand for academic employment as between 80,000 and 125,000 depending on evolving educational standards. The resulting "demand" is likely to fall between 210,000 and 255,000. He estimates the production of the graduate schools will be between 325,000 and 375,000 by 1985.

13. *Science and Engineering Science*, July 16, 1971.

14. The report projects total annual baccalaureates increasing by 48 percent between 1968 and 1980. Degrees at the master's level and the doctoral level are projected to increase by 95 percent and 117 percent respectively. This means a total of 13 million degrees to be awarded between 1968 and 1980—10.2 million bachelor's degrees, 2.7 million master's degrees, and 400,000 doctoral level degrees.

15. Cartter anticipates that the surplus of doctoral graduates will "bump" those with lesser degrees from positions in junior colleges and high schools.

16. There were two pages in the author's draft entitled "Too Much Science Already?" which have been eliminated because the argument was not fully elaborated and further was not integrated with the preceding analysis or the recommendations which follow. Bakke argued that no matter what, science and technology would be aggressively pursued for reasons of defense and the best hope for correcting its excrescences lay with the scientists themselves.

17. While I have substantially reordered what the writer referred to as "Action Options" I have not added or subtracted any material from his draft except as noted here: The introductory statement is based on a recommendation of his collaborator, Professor Harbison; and the last two recommendations—4f and 4g—represent a reformulation and addition recommended by Professors Harbison and Myers.